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## Phytotherapy in the Management of Diabetes Mellitus: An Overview.

Mani Rupeshkumar<sup>1</sup>, Kunchu Kavitha<sup>1</sup>, and Pallab Kanti Halder<sup>2,\*</sup>.

<sup>1</sup>East Point College of Pharmacy, Bidarahalli, Bangalore - 49, Karnataka, India.

<sup>2</sup>Department of Pharmaceutical Technology, Jadavpur University, Kolkata - 32, West Bengal, India.

### ABSTRACT

Diabetes mellitus (DM) is a metabolic disorder characterized by hyperglycemia, abnormal lipid, and protein metabolism along with specific long-term complication affecting the retina, kidney, and nervous system. Diabetes mellitus has a significant impact on the health, quality of life and life expectancy of patients as well as on the health care system. Diabetes mellitus has been recognized as a growing worldwide epidemic by much health's advocacy group including World health Organization (WHO). The WHO has estimated that diabetes will be one of the world leading causes of death and disability with next quarter century. Oral hypoglycaemic agents like sulphonylureas and biguanides are still the major players in the management of the disease but there is growing interest in herbal remedies due to the side effects associated with the oral hypoglycaemic agents. Herbal medicines have been highly esteemed source of medicine throughout the human history. They are widely used today indicating that herbs are a growing part of modern high-tech medicine. Some of the herbal plants which have a role in the management of diabetes mellitus are compiled and discussed in this review.

**Keywords:** Diabetes Mellitus, Blood Sugar, Insulin, Hypoglycaemic agents, Herbal treatment.

*\*Corresponding author*

## INTRODUCTION

Medicinal plants represent a vital natural wealth of a country. They play a major role in providing primary health care services to rural population. They function as therapeutic agents moreover as vital raw materials for the manufacture of traditional medicines. India is one in all the world's twelve leading diversity centres with the presence of over 45,000 different plant species. Before the eighteenth century solely slow progress was created within the field of phytochemistry. Medicinal plants are believed to be a vital supply of recent chemical substances with potential therapeutic effects. Till the centre of the 20<sup>th</sup> century the most emphasis in natural product chemistry remained in the isolation and structure determination of a large type of compounds. Physicians and patients are in need of effective therapeutic agents with a low incidence of side-effects. In recent years, several researchers have examined the consequences of plants used traditionally by indigenous healers and herbalists. The WHO has listed 21,000 plants that are used for medicinal functions round the world [1]. Therefore, with the rising range of diseases late, several researchers have evaluated the medicinal plants as alternative therapeutic agents.

### Diabetes Mellitus and Phytotherapy

The importance of herbal therapy in treatment of type 2 Diabetes Mellitus seems to gradually increase in coming years. Phytotherapy can be effective in prevention of diabetes and its complications as well as optimization of the treatment and life standards. As in case of many chronic metabolic diseases, the mechanism is closely connected, significantly in diabetes, to oxidative stress and inflammation in the body. Therefore, due to the antioxidant properties herbs should be considered for both prevention and treatment of diabetes [2]. A multitude of herbs and medicinal plants and a few compounds refined from them are studied for the treatment of diabetes throughout the world as they could offer a basis of new synthetic antidiabetic analogues with potent activity.

The hypoglycaemic effect of several plants used as antidiabetic remedies has been confirmed, and also the mechanisms of hypoglycaemic activity of those plants are being studied. However, search for new anti-diabetic drugs continues. As per ancient literature, more than 800 plants are reported to have antidiabetic properties [3]. Ethanopharmacological surveys indicate that more than 1200 plants are utilized in traditional medicine for their allied hypoglycemic activity [4]. Indian Materia Medica has mentioned numerous dravyas have been reported effective in Madhumeha [5]. The indigenous diet may not be useful in lowering the blood sugar to the same extent as insulin and other hypoglycaemic agent do; however it's another influence, which can be helpful for the management of the disease and its complications [6].

World Health Organization (WHO) has recommended the evaluation of traditional plant treatments for diabetes as they are effective, non-toxic, with less or no side effects and are considered to be excellent candidates for oral therapy [7-13]. This review discusses the drugs of plant origin which have shown significant hypoglycemic activity, even in some cases with good potency. There is an increasing demand by patients to use the natural products with anti-diabetic activity [14]. Herbal therapy has been used to treat various types of disease including diabetes all over the world successfully. From the scientific research, it was found that several plant species have proven efficacy to reduce the sugar level. By screening of anti-diabetic drugs, a large number of plant materials including phytoconstituents were found to possess potent anti-diabetic activity [15-17]. Hemalatha et al., reported the pharmacologically tested anti-diabetic plant materials in streptozotocin induced diabetic animal model [18]. In this review, a listing of data on medicinal plants used in the treatment of diabetes has been presented.

***Momordica charantia***: Also referred to as bitter melon, has been used extensively in folk medicine as a remedy for diabetes. The blood sugar lowering action of fresh juice or unripe fruit has been established in animal experimental models as well as human clinical trials [19-24].

***Azadirachta indica***: Commonly known as neem. It has been long used as a treatment for diabetes. Aqueous extract of neem leaves significantly decreases blood sugar level and prevents adrenaline as well as glucose-induced hyperglycaemia [25].

***Cinnamomum***: Used to flavour deserts and cookies, was recorded to be used as a kind of spice in the Chinese documents dating back to 4000 years ago. Mechanism of activation of cinnamon on glycaemic control has not

been duly understood as yet; however, it has been reported to have insulin-like effects and improve insulin sensitivity by its active compound, classified as Methyl Hydroxy Chalcone Polymer (MHCP) [26, 27].

**Olive Leaf:** Leaves of olive tree yield two potent antioxidants specifically oleuropein and hydroxytyrosol which may also act as antidiabetics. Alcohol-extract of olive leaves has been reported to increase insulin secretion in diabetic rats- but not in healthy rats- and the antiglycaemic effects were higher when compared to glibenclamide [28].

**White Mulberry:** Leaf extract is employed as a folkloric remedy for treatment of diabetes. *Morus alba* leaf extract was found to lower vascular reaction due to its long-lasting antioxidant effect and was recorded to have antihyperglycaemic effect [29].

**Bauhinia forficata:** Most widely used herbal medicine for management of diabetes in Brazil, where it is known as Pata de Vaca (cows hoof) [30].

**Gymnema sylvestre:** The *Gymnema sylvestre* crude extracts and its isolated compound dihydroxy gymnemic triacetate shows hypoglycaemic effect against streptozotocin induced diabetic rats in dose and time dependent manner [31].

**Ricinus communis:** Traditional medicine which was used for the management of Diabetes mellitus. Castor oil has been used in classical Egyptian and Greek medicine and their use has been described in the Susruta and Ayurveda as early as sixth century B.C [32].

**Combretum micranthum:** Used for treating diabetes in North-western Nigeria. It is commonly known as 'geza' in Hausa, belong to the family of Combretaceae. It is a widely known ethno medicinal plant used in West Africa for treating several diseases [33, 34].

**Sarcopoterium spinosum:** Common medicinal plant in the Mediterranean region, and it is widely used as an antidiabetic drug by Bedouin healers. The ethnobotanical surveys reported as a medicinal plant, used by traditional Arab and Bedouin medicine for the management of diabetes, digestive problems, pain relief or cancer [35].

**Parinari excels:** Used to manage the Diabetes mellitus; the decoction is one of the most widely used medicinal plant [36].

**Elephantopus scaber:** An ethnomedicinal plant, having the property to reduce the blood glucose levels in streptozotocin induced diabetic rats significantly. As per the previous studies, the roots of *Elephantopus scaber* are used as an antipyretic, cardiotoxic and diuretic [37].

**Liriope spicata:** Chinese medicinal plant, which belongs to Liliaceae family. It is frequently used as "maidong" in prescriptions of traditional Chinese medicine for the treatment of Diabetes mellitus, because of the high availability and safety [38].

**Coccinia indica (ivy gourd):** Creeping plant that grows wildly in many parts of the India subcontinent, and is used to treat "sugar urine" (madhumeha) in Ayurveda, a traditional East Indian healing system. The mechanism of action is not well understood, but the herb appears to have insulin-mimetic properties [39, 40].

**Ginseng species:** Several different plant species are often referred to as ginseng. Principal components are believed to be the triterpenoid saponin glycosides (ginsenosides or panaxosides). Hypoglycemic effects have been shown in streptozotocin rat models [41].

**Allium species:** *Allium sativum* (garlic), a member of the lily family, is most commonly used worldwide for flavorful cooking. Experiments in animal models with alloxan-induced diabetes have shown moderate reductions in blood glucose; no effect is seen in pancreatectomized animals. *Allium cepum* (onion) also contains allyl propyl disulphide and has similar purported hypoglycemic properties [42].

**Ocimum sanctum:** Studies in animal models suggest hypoglycemic effects [103], although the mechanism of action remains unknown. Postulated effects include enhanced  $\beta$ -cell function and insulin secretion [43].

**Trigonella foenum graecum (fenugreek):** Defatted seeds of fenugreek, which are rich in fiber, saponins, and protein, have been described in early Greek and Latin pharmacopoeias for hyperglycemia [44].

**Ficus carica:** Several studies in animal models with diabetes have shown both short- and long-term hypoglycemic effects, although human trials are lacking. Potential hypolipidemic effects in diabetic rats have also been shown [45].

**Opuntia streptacantha (nopal):** Found in arid regions throughout the Western hemisphere, including the southwestern U.S., and is commonly used for glucose control by those of Mexican descent. It has a high-soluble fibre and pectin content, which may affect intestinal glucose uptake, partially accounting for its hypoglycaemic actions [46].

**Momordica charantia:** Vegetable indigenous to tropical areas, including India, Asia, South America, and Africa. Theoretical mechanisms include increased insulin secretion, tissue glucose uptake, liver muscle glycogen synthesis, glucose oxidation, and decreased hepatic gluconeogenesis. Studies in alloxan-induced diabetic rabbits have suggested hypoglycemic effects [47].

**Aloe vera:** It is popularly used to treat burns and promote wound healing. The dried sap is a traditional remedy for diabetes in the Arabian Peninsula. Aloe gel, obtained from the inner portion of the leaves, contains glucomannan, a hydrosoluble fiber which may in part account for its hypoglycemic effects [48].

Other herbs that have been studied solely in uncontrolled trials include *berberine* [49], *Cinnamomum tamala* [50], *curry* [51], *Eugenia jambolana* [52], *gingko* [53], *Phyllanthus amarus* [54], *Pterocarpus marsupium* [55], *Solanum torvum* [56], and *Vinca rosea* [57].

## CONCLUSION

The efficacy of herbal drugs is significant and they have negligible side effects than the synthetic anti diabetic drugs. In this review article an attempt has been made to focus on hypoglycaemic plants and may be useful to the health professionals, scientists and scholars working in the field of pharmacology & therapeutics to develop evidence based alternative medicine to cure different kinds of diabetes in man and animals. Isolation and identification of active constituents from these plants, preparation of standardized dose and dosage regimen can play a significant role in improving the hypoglycemic action; thereby, it will be of great importance to interested readers to easily identify and choose additional research on the plant of their interest.

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